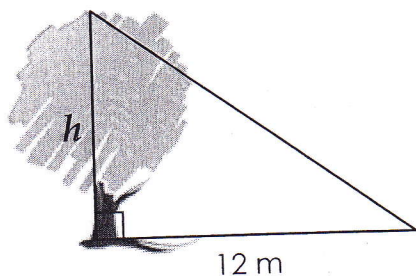
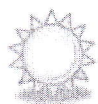


A) Measurement and Trigonometry

- A1) A tree casts a shadow that is 12 m long. At the same time, a student who is 167 cm tall casts a shadow 125 cm long.

Determine the height of the tree.



Ratios

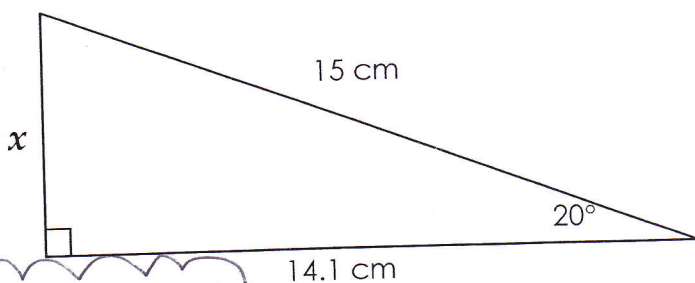
$$\frac{h}{167} = \frac{12}{125}$$

$$167 \times \left(\frac{h}{167} \right) = \left(\frac{12}{125} \right) \times 167$$

$$h = 16.032$$

∴ the height of the tree is 16.03m

- A2) **Determine** the value of x.



Hint: you could use tan or Pythagorean

$$\sin \theta = \frac{O}{H}$$

$$\sin 20^\circ = \frac{x}{15}$$

$$15 \times \sin 20^\circ = \frac{x}{15} \times 15$$

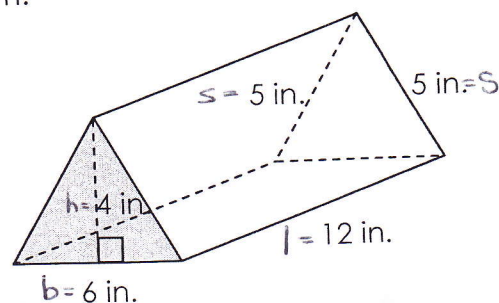
$$5.13 = x$$

∴ the value of x is 5.1 cm

- A3) **Determine** the surface area of the triangular prism.

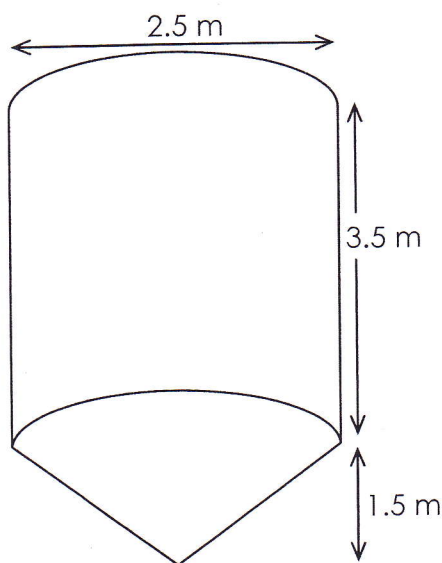
$$\begin{aligned} SA &= bh + bl + 2sl \\ &= 6(4) + 6(12) + 2(5)(12) \\ &= 216 \end{aligned}$$

∴ the SA of the triangular prism is 216 in²



A4) A transport silo has dimensions as shown in the diagram.

a) **Determine** the volume of grain that the silo can hold.



Volume of cylinder

$$\begin{aligned} V &= \pi r^2 h \\ &= \pi (1.25)^2 (3.5) \\ &= 17.180 \end{aligned}$$

Volume of Cone

$$\begin{aligned} V &= \frac{1}{3} \pi r^2 h \\ &= \frac{1}{3} \times \pi \times (1.25)^2 \times 1.5 \\ &= 2.454 \end{aligned}$$

$$\begin{aligned} \text{Total Volume} &= 17.180 + 2.454 \\ &= 19.634 \end{aligned}$$

∴ the volume of the silo is 19.6 m^3

b) The farmer wants to ship his grain to his clients using grain boxes. It takes 10 boxes to hold the grain from the silo. **Describe** one possible set of dimensions for the grain boxes.

Step 1: Determine how much grain will fit in each box

$$19.6 \text{ m}^3 \div 10 \text{ boxes} = 1.96 \text{ m}^3 (1 \text{ box})$$

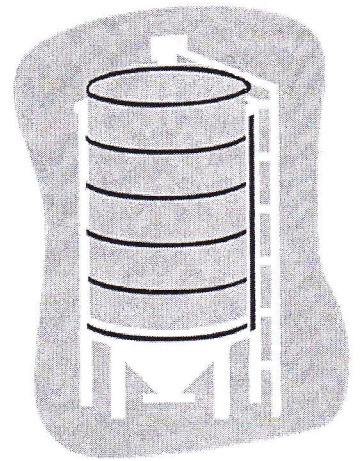
Step 2: Determine size of each box

Volume of rectangular prism — $V = l \times w \times h$

$$= 1 \times 2 \times 1$$

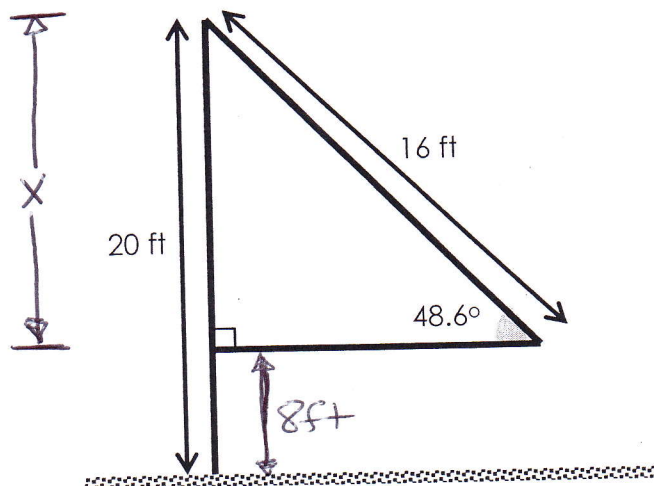
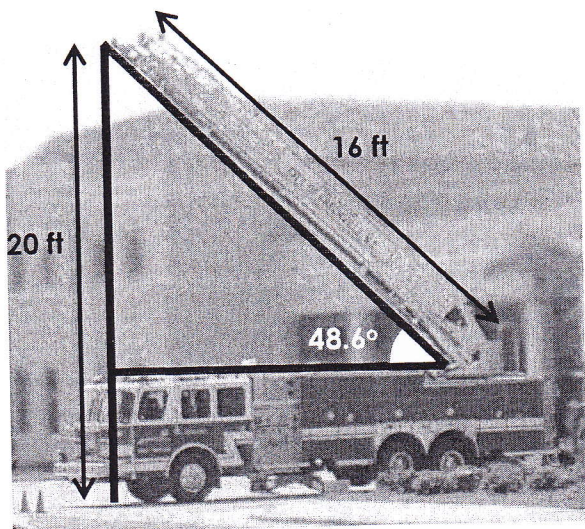
$$= 2 \text{ m}^3 \text{ [will hold } 1.96 \text{ m}^3 \text{]}$$

∴ the dimensions of my box will be $1 \text{ m} \times 2 \text{ m} \times 1 \text{ m}$



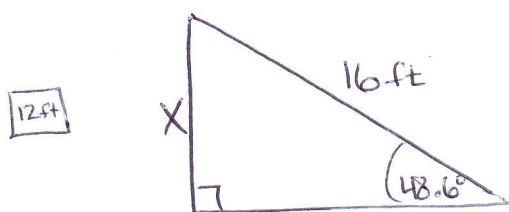
A5) An extendable ladder on a fire truck has an initial length of 16 ft.

The ladder is raised to an angle of 48.6° , and reaches a height of 20 ft above the ground.



Determine the height above the ground that the ladder reaches when it is extended from 16 ft to 88 ft.

Triangle 1



$$\sin \theta = \frac{O}{H}$$

$$\sin 48.6 = \frac{X}{16}$$

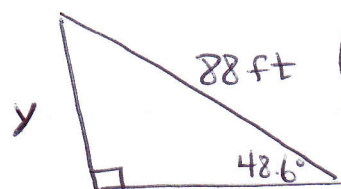
$$16 \times \sin 48.6 = \frac{X}{16} \times 16$$

$$12.00 = X$$

Height of fire truck is
 $20 \text{ ft} - 12 \text{ ft} = \boxed{8 \text{ ft}}$

Triangle 2

Triangle 1 ~ Triangle 2



$$\sin \theta = \frac{O}{H}$$

$$\sin 48.6 = \frac{Y}{88}$$

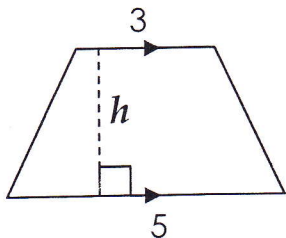
$$88 \times \sin 48.6 = \frac{Y}{88} \times 88$$

$$66.00 = Y$$

∴ the ladder reaches 74 ft above the ground.

B) Modelling Linear Relations

B1) Determine h , the height of the trapezoid.



$$A = \frac{(a+b)h}{2}$$

$$28 = \frac{(3+5)h}{2}$$

$$28 = \frac{(8)h}{2}$$

$$2 \times 28 = \frac{(8)h}{2} \times 2$$

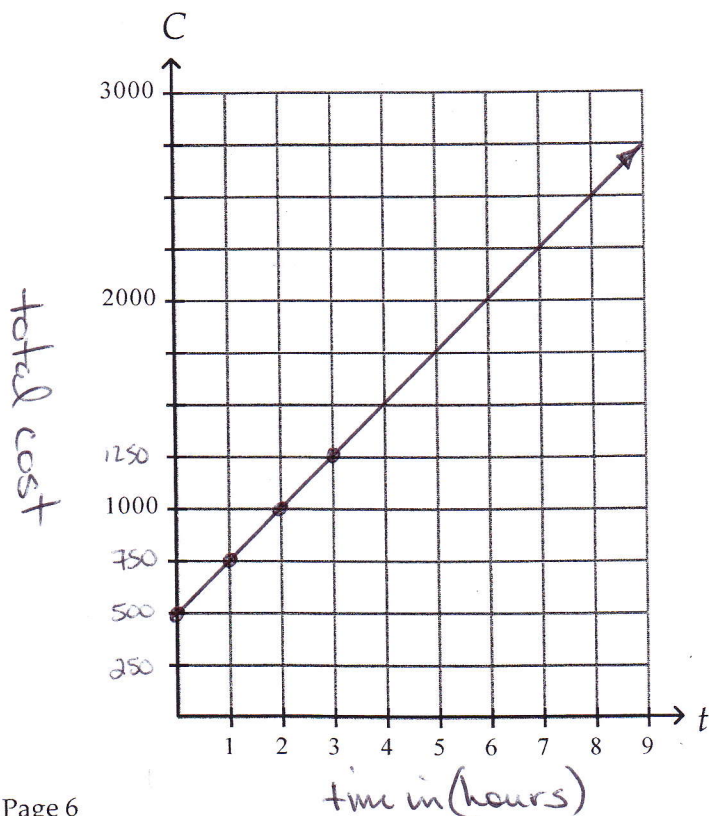
$$\frac{56}{8} = \frac{8h}{8}$$

$$7 = h$$

∴ the height of the trapezoid is 7 units

B2) A lawyer's costs are modelled by $C = 500 + 250t$, where C represents the total cost in dollars and t represents the time in hours.

Graph the relation.

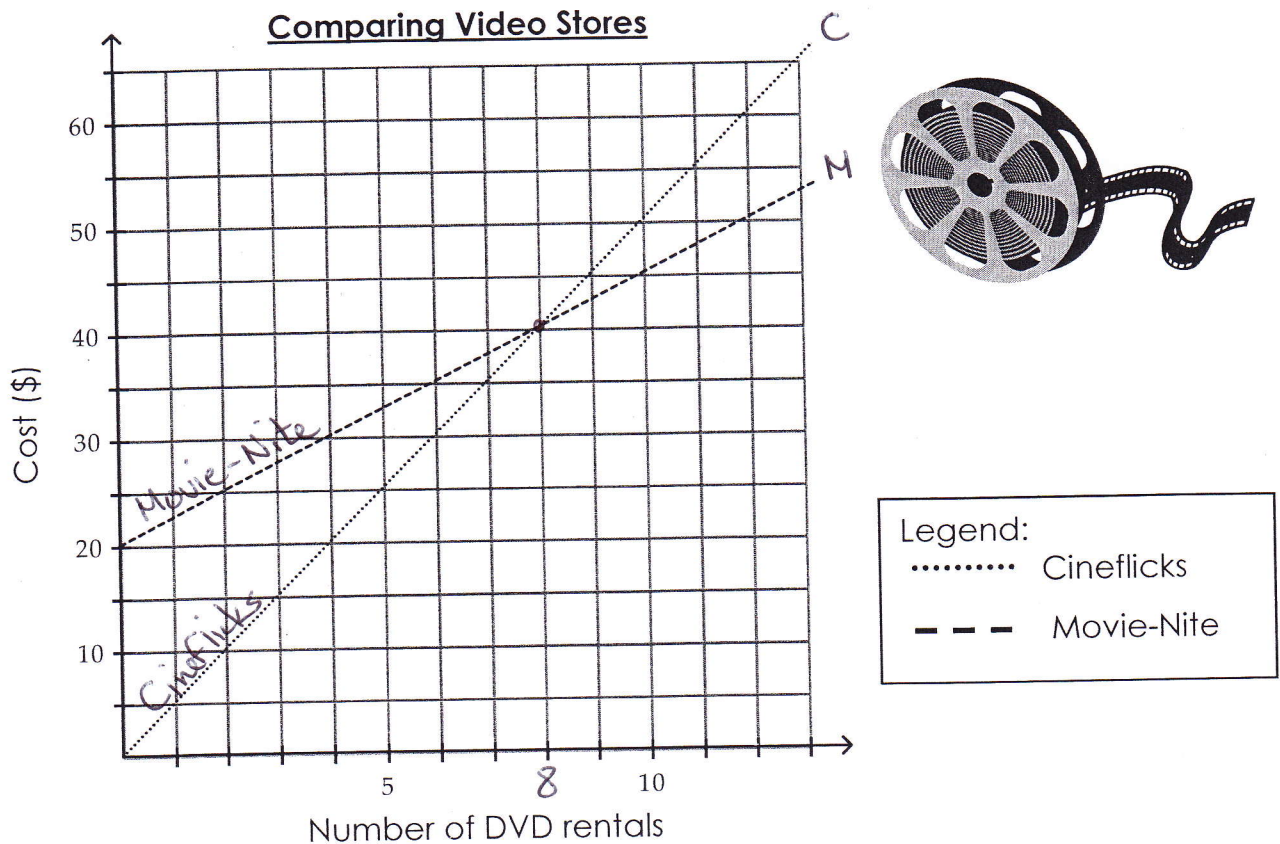


You could use this table to help

t	C
0	500
1	750
2	1000
3	1250

B3) Annie is comparing two local video stores:

- ❖ Cineflicks charges \$5 per DVD rental
- ❖ Movie-Nite charges a yearly membership of \$20 and then \$2.50 per DVD rental



State the point of intersection. **Explain** what it means to Annie.

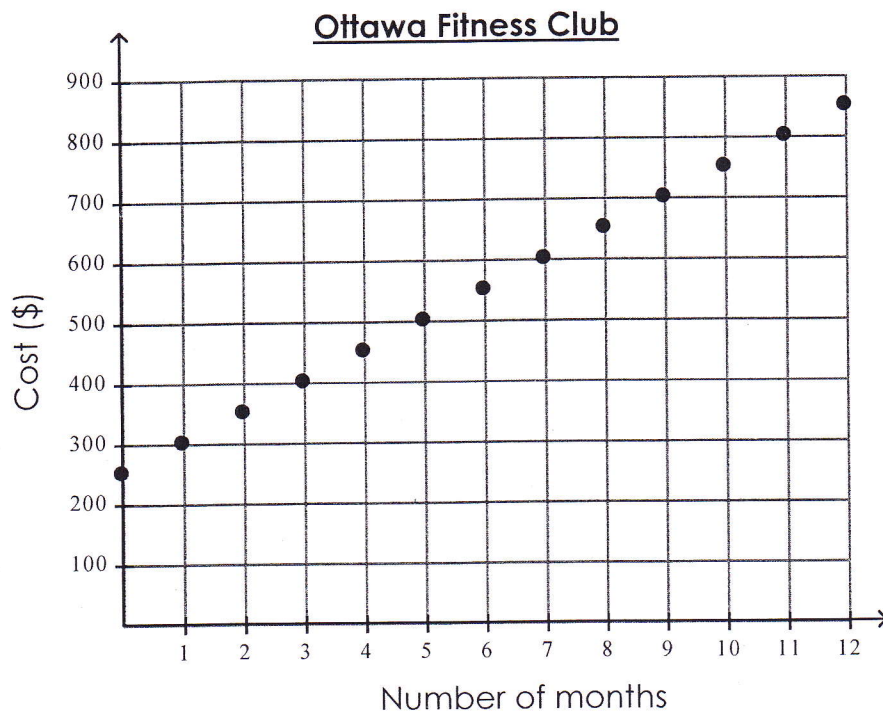
∴ the point of intersection is $(8, 40)$

if Annie rents less than 8 movies, it would be cheaper to use Cineflicks.

if Annie rents more than 8 movies, it would be cheaper to use Movie-Nite.

if Annie rents exactly 8 movies, both video stores charge the same.

B4) Jerry wants to join a gym. Most gyms charge a registration fee and a monthly fee. The graph shows the total cost for Ottawa Fitness Club.



a) **State** the y -intercept and **explain** what it means in this situation.

- the y -intercept is 250
- the 250 is the registration fee. It is the initial cost of joining the gym.

b) **Determine** the slope. Then **explain** what the slope means in this situation.

the slope is \$50
the slope represents the monthly cost for using the gym.

c) **Determine** an equation to model the relation for Ottawa Fitness Club.

$$y = 50x + 250$$

- d) Another gym has a lower registration fee than Ottawa Fitness Club, but charges the same monthly fee. **Describe** how the graph would be different from the graph for Ottawa Fitness Club.

example: $y = \underline{50}x + \underline{150}$

same different

The graph of the another gym

The line would start lower on the y axis but increase each month by the same (\$50) amount.

- e) Ottawa Fitness Club currently charges \$500 for 5 months. **Describe** two possible ways they could change their fees so that 5 months would cost \$600.

A) $y = 50x + 350$

- they could have an initial fee of \$350 and a monthly cost of \$50.

B) $y = 40x + 400$

- they could have an initial fee of \$400 and a monthly cost of \$50.

A) $600 = 50(5) + 350$

$$600 = 250 + 350$$

$$600 = 600$$

B) $600 = 40(5) + 400$

$$600 = 200 + 400$$

$$600 = 600$$

- B5) Three footballs and one soccer ball costs \$105.
Two footballs and one soccer ball cost \$82.



- a) **Determine** the costs of one football and one soccer ball.
(i.e. solve the system)

$$\begin{array}{rcl} \textcircled{1} & 3x + y & = 105 \\ - & - & - \\ \textcircled{2} & 2x + y & = 82 \\ \hline & x & = 23 \end{array} \quad \left. \vphantom{\begin{array}{rcl} \textcircled{1} & 3x + y & = 105 \\ - & - & - \\ \textcircled{2} & 2x + y & = 82 \end{array}} \right\} \text{Elimination}$$

sub $x = 23$ into $\textcircled{1}$

$$3x + y = 105$$

$$3(23) + y = 105$$

$$\textcircled{69} + y = 105$$

$$y = 105 - 69$$

$$y = 36$$

∴ one football costs \$23
∴ one soccer ball costs \$36.

- b) The Athletics Department has a total of \$500 to spend.
Determine a possible combination of footballs and soccer balls that they could buy that will leave them with less than \$15.

Trial & Error - guessing

$$9x + 8y = ?$$

$$9(23) + 8(36) = 495$$

∴ they could buy
9 soccer balls &
8 footballs that
would leave them with
less than \$15.

C) Quadratic Relations

C1) Factor $2x^2 + 8x$

$$= 2x(x + 4)$$

Check

$$= 2x(x + 4)$$

$$= 2x^2 + 8x \quad (\text{back to original})$$

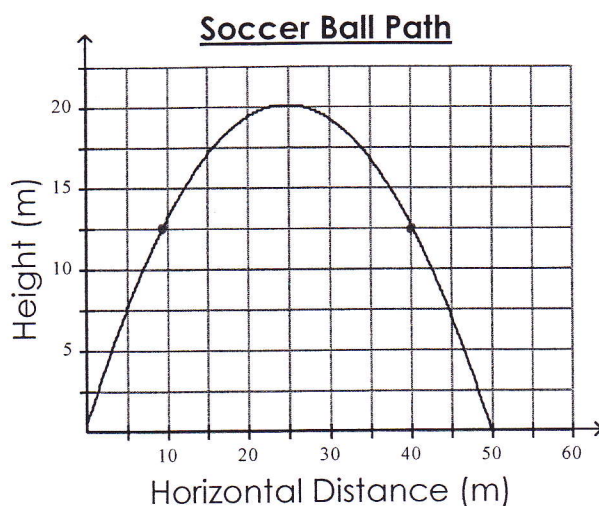
C2) Given $y = x^2 + 3x + 2$

$$= (x + 1)(x + 2)$$

State the x -intercepts -1 & -2

State the y -intercept 2

C3) A soccer player kicks a ball and the path of the ball, comparing horizontal distance travelled to the height of the ball, is modelled by the graph below.



State the following:

a) The maximum height the ball reaches.

\therefore it reaches a maximum height of 20m

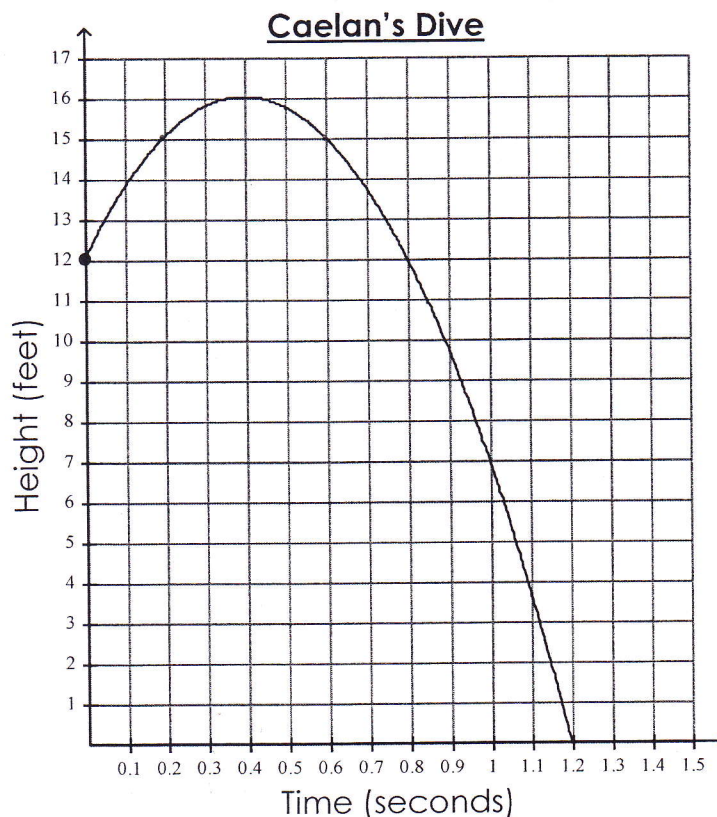
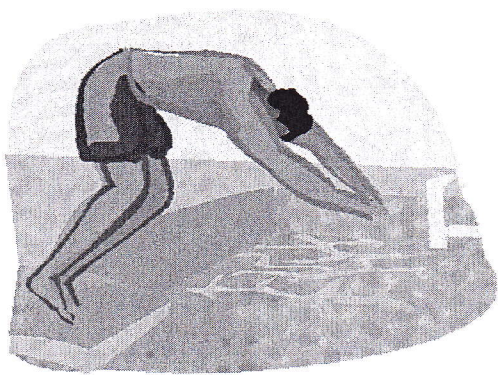
b) How far the ball travels horizontally.

\therefore the ball travels 50m horizontally

c) The horizontal distance(s) when the ball is 12.5 metres off the ground.

approximately 9m and 40m

- C4) Caelan jumps from a platform and dives into the water. The graph of the dive is shown.



- a) **State** the y -intercept and **explain** what it means in this situation.

the y -intercept is 12 ft. This^{is} the height of the platform Caelan jumps from.

- b) **Determine** the amount of time the diver is above 15ft. **Justify** your answer.

The diver is above 15ft for 0.4 seconds.

The curve crosses 15ft at two points. One at 0.2 seconds and the other at 0.6 seconds.

If I subtract the two it means the diver is above 15ft for 0.4 seconds.

c) **State** the vertex and **explain** what it means in this situation.

The vertex is $(0.4, 16)$. This means at 0.4 seconds the diver reaches his maximum height of 16 ft.

d) **State** the zero shown on the graph and **explain** what it means in this situation.

The zero shown on the graph is 1.2 seconds. This means that it takes 1.2 seconds for the diver to hit the water.

e) **Determine** the location of the other zero for this relation if the graph continued. **Explain** why this zero is not shown on the graph.

If the graph continued to the left the zero would be -0.4 seconds.

In real life it is not possible to have negative time. Also Caelan jumps off a 12 ft platform and not off the ground.

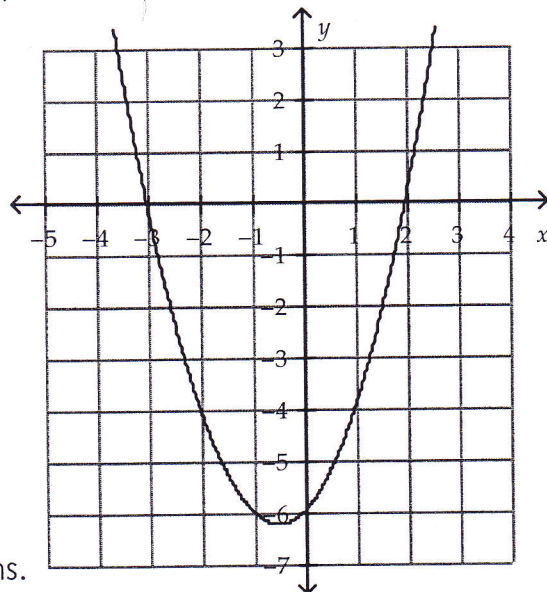
C5) Mme. Lamoureux gave her class the following problem:

"The graph shows $y = x^2 + x - 6$.

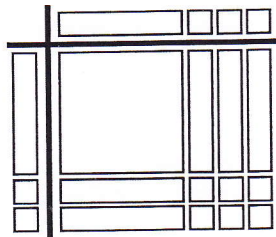
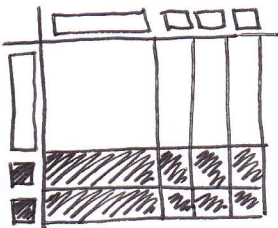
Factor $y = x^2 + x - 6$. Use the model you prefer"

$$= (x + 3)(x - 2)$$

$$\begin{array}{r} 3 \times 2 \\ \cancel{6 \times 1} \\ +3 - 2 = +1 \end{array}$$



Three students gave the following incorrect solutions.

Incorrect Solutions	Explain what the students did wrong									
<p>Tabatha's Solution</p>  <p>$(x^2 + 3x + 2x + 6)$</p>	 <p>↑ Tabatha should have made these 1s negative. This changes the area answer $(x^2 + 3x - 2x - 6)$</p>									
<p>Phil's Solution</p> $y = x^2 + x - 6$ $y = (x + 2)(x - 3)$	<p>The + & - signs in the brackets need to be reversed so that the middle term is positive and not negative.</p>									
<p>Sandeep's Solution</p> <table border="1"> <tr> <td></td><td>x</td><td>$+1$</td></tr> <tr> <td>x</td><td>x^2</td><td>$+1x$</td></tr> <tr> <td>-6</td><td>$-6x$</td><td>-6</td></tr> </table>		x	$+1$	x	x^2	$+1x$	-6	$-6x$	-6	<p>When the two middle terms are simplified the result will be $-5x$ which is not correct. This means that the two brackets that multiple together are wrong $(x + 1)(x - 6)$</p>
	x	$+1$								
x	x^2	$+1x$								
-6	$-6x$	-6								

Create a correct solution

$$= (x + 3)(x - 2)$$